WEED CONTROL IN THE ESTABLISHMENT OF LIMPO GRASS (*HEMARTHRIA ALTISSIMA*)

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SUMMARY

Weed control was evaluated in trials investigating the effects of nurse crops and herbicides on the vegetative establishment of limpo grass (*Hemarthria altissima*). Target weed species varied with planting time. A white mustard nurse crop suppressed weeds and protected establishing limpo grass stolons from birds and frost. Foliar applications of paraquat, glyphosate and fluzafop-butyl killed limpo grass. Atrazine, simazine, ethofumesate and metolachlor gave variable control of both cool and warm season annual grass weeds. Dicamba provided the best control of broadleaf weeds. Limpo grass was sensitive to 2,4-D, causing swelling of nodes, shortening of internode length, and brittleness of stolons.

Keywords: limpo grass, *Hemarthria altissima*, nurse crops, herbicides.

INTRODUCTION

Integrated weed control programmes including selective herbicides capable of controlling both grass and broadleaf weeds are needed to promote the establishment of limpo grass. Initial evaluations of limpo grass have demonstrated the potential of this South African species as a special purpose perennial summer forage for cattle on moisture retentive alluvial soils receiving nitrogen and perhaps irrigation (Taylor *et al.* 1976; Rumball 1989). One of the disadvantages is the need for vegetative establishment from stolon cuttings, as most accessions do not set viable seed in any quantity (Schank *et al.* 1972). Mechanical planting methods have been compared in the United States (Ruelke *et al.* 1979). Most experimental plantings in New Zealand have been made using a mechanical kumara planter at nine stolon cuttings/m² on cultivated soil during summer (January) with irrigation and few if any herbicides applied. The kumara planter buries two thirds of the stolon and leaves the remaining part exposed. This planting method has led to variable results. Such systems can only be successful in the absence of weed competition.

Under New Zealand conditions, the composition of weed populations affecting limpo grass establishment varies with the time of year at which planting occurs. Early plantings during November, December and January have been infested with smooth witchgrass (*Panicum dichotomiflorum*) and summer grass (*Digitaria sanguinalis*) (Davies and Hunt 1989). Later plantings in February and March were infested with annual poa (*Poa annua*) and perennial ryegrass (*Lolium perenne*). Broadleaf weeds are a problem regardless of planting time, and annual poa establishes during autumn and winter where the soil surface is left exposed. Dense weed populations have resulted in poor limpo grass stands the following summer.

Little information is available on the use of herbicides to selectively suppress weeds in limpo grass. In Florida, dicamba and bentazone applied within 10 days of planting have been used to control broadleaf weeds and sedges, respectively. 2,4-D was found to be more toxic to limpo grass than to other tropical grasses (Quesenberry, pers. comm.). Paraquat at 0.56 kg/ha has been used to introduce legumes to mature limpo grass sods, but the grass was very slow to initiate new growth after treatment (Sollenberger and Quesenberry 1985). In Northland, Davies and Hunt (1989) used

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ethofumesate and propyzamide, but the limpo grass cultivar Bigalta was sensitive to recommended rates applied in spring. This paper reports a series of observational trials at Kaikohe investigating the effects of a range of nurse crops, and pre- and post-planting herbicides on limpo grass establishment.

MATERIALS AND METHODS

Nurse crops to suppress weeds in establishing limpo grass

Limpo grass establishment was assessed under a range of nurse crops on a Waipu clay soil. This trial consisted of seven treatments (Table 1) with three replicates in a randomised complete block design. This was repeated on two areas of limpo grass which had been planted at different times during autumn. Plots were 3 x 3 m. Isazaphos (Miral 10G) at 2 kg/ha was applied to control black beetle (*Heteronychus arator*) during April.

Floralta stolon cuttings were planted into cultivated soil using a mechanical kumara planter on 3 and 17 March 1992. Nurse crop seed was broadcast onto the soil surface of both areas on 13 April 1992. Nurse crop seedling establishment counts were taken 4 weeks after sowing. Plots were mown during spring to remove nurse crop growth and reduce competition to establishing limpo grass. The number of limpo grass stolon growing tips was counted in March 1993.

Effects of herbicides on limpo grass

Effects of herbicides were assessed in a glasshouse pot trial comparing two limpo grass cultivars, ten herbicide treatments, and three methods of application. The trial was laid out as a randomised complete block design with six replicates. Stolon cuttings of the tetraploid limpo grass accessions Bigalta and Floralta were established in potting mix during April 1992, before being transplanted to 10 cm pots (one plant/pot) filled with Papakauri silt loam soil in July 1992. Water and fertilisers were supplied as required.

Herbicide applications were made in early September 1992. Herbicide treatments and rates used were: paraquat (Gramoxone) 0.4 kg/ha, glyphosate (Roundup) 2.2 kg/ha, fluzifop-butyl (Fusilade) 0.4 kg/ha + Pulse, simazine (Gesatop 500FW) 1.5 kg/ha, atrazine (Actazine 5A) 1.5 kg/ha, atrazine 1.5 kg/ha + Pulse, 2,4-D (2,4-D Ester 80EC) 2.2 kg/ha, dicamba (Banvel 200) 0.4 kg/ha, metolachlor (Dual 960EC) 2.9 kg/ha, pendimethalin (Stomp 330E) 2.0 kg/ha, with untreated controls. Full foliar applications were made to pots laid out randomly over a known area using a knapsack. Contact applications were applied as large spots on two leaves/plant (the first and third fully unfolded leaves on the primary stolon) using a paint brush. Soil applications were poured onto the pot surface, avoiding any contact with leaves or stolons. Appropriate amounts of herbicides were made up to 78 ml with distilled water before being applied to the pots, which had a surface area of 78.5 cm². Plants remained in the glasshouse for 8 weeks following application and visual observations for symptoms of toxicity were made throughout this period. Yield harvests were not taken.

Post-planting herbicide field trial

Nine herbicides (Table 2) were assessed in a field trial on a Waipu clay soil. Plots of 3 x 3 m were laid out as a randomised complete block design with three replicates. A mixture of Floralta and Bigalta limpo grass stolon cuttings was planted in alternating rows into cultivated soil using a mechanical kumara planter during January 1993. Dry conditions necessitated the use of irrigation to assist stolon establishment. In early March 1993 herbicide treatments were applied using a knapsack. Dry conditions prevailed after treatment application. Untreated plots were not weeded. Weeds affected and toxicity symptoms in limpo grass were noted. The number of limpo grass plants were assessed during the following autumn (May 1994).

Pre- and post-planting herbicide field trial

Five herbicides (Table 3) were assessed on a Waipu clay soil in a field trial aimed at reducing competition from annual poa. The trial was laid out as two randomised complete block designs with three replicates. One of the trials examined pre-planting herbicide applications, the other post-planting applications. Plots were 5 x 2 m.

Herbicide treatments were applied using a knapsack sprayer. Pre-planting treatments were applied on 2 March 1993. Mechanical planting using a kumara planter occurred on 3 March 1993. Post-planting treatments were applied on 5 March 1993. 10 mm of rainfall fell within 5 days of pre-planting treatments. 11 mm fell within 8 days of post-planting treatments. In June 1993 plots were scored for the amount of bare ground present, and the condition of the establishing limpo grass stolons (0 = dead, 5 = leafy and no damage symptoms).

RESULTS AND DISCUSSION

Nurse crops to suppress weeds in establishing limpo grass

Some black beetle damage to limpo grass stolons occurred during May, before isazaphos application. Birds attacked plots removing much of the sown seed. Small birds foraged the area. Pukeko (*Porphyrio porphyrio melanotus*) removed or damaged germinating oat and lupin seed. Seedling counts of the two limpo grass planting times (Table 1) were similar. The number of limpo grass stolon growing tips on the earlier planting was greater than the later planting. The later planting area was more affected by pukeko damage.

TABLE 1: Nurse crop treatments, sowing rate, sown species seedling counts taken on 8 May 1992, and limpo grass stolon tip counts taken on 19 March 1993, for two planting times of limpo grass.

Nurse crop	Sowing rate (kg/ha)	Sown species (seedlings/m ²)		Limpo stolons (tips/plot)	
		Planting times		Planting times	
		3.3.92	17.3.92	3.3.92	17.3.92
white mustard	5	210	225	188	77
blue lupin	200	61	70	113	44
subclover	4	37	50	144	29
oats	100	33	30	108	40
red clover	4	260	225	111	20
annual ryegrass	20	338	345	74	18
untreated				120	38
LSD (0.05)		97	80	75	26

Annual poa was the main weed species. White mustard (*Sinapis alba*) was most effective, quickly forming a complete ground cover which suppressed weeds and provided protection from pukeko and frosts. When white mustard herbage was removed in spring, plots were virtually weed free, allowing the small and previously shaded limpo grass plants to quickly initiate new growth. Annual ryegrass (*Lolium multiflorum*) cv. Tama had reasonable early growth, providing some frost protection but also allowed light penetration of the canopy. During spring and early summer annual ryegrass plants were still growing. To avoid competition with the young limpo grass plants, it would be desirable for the annual ryegrass to have completed its life cycle before limpo grass became active in late spring. An earlier flowering annual ryegrass selection would be required. Subclover (*Trifolium subterraneum*) cv. Woogenellup was too slow establishing, with most growth occurring during spring, too late to provide frost protection for stolons. Ground cover was inadequate to suppress weeds, although stolon counts in the later planting were good. Red clover (*Trifolium pratense*) cv. Colenso had better speed of establishment than subclover, but there was still insufficient growth to provide early ground cover and frost protection. Red clover is unlikely to be suited to the soil types to which limpo grass is best adapted. Oats (*Avena sativa*) cv. Hattrick and blue lupin (*Lupinus angustifolius*) were eaten by pukeko and magpies, and failed to provide sufficient cover.

Effects of herbicides on limpo grass

Complete foliar application of paraquat, glyphosate, and fluazifop-butyl killed limpo grass. Death also resulted from contact or spot applications of glyphosate and fluazifop-butyl indicating translocation. There were some differences between the limpo grass cultivars in survival from foliar applications of glyphosate, and contact and soil applications of fluazifop-butyl, indicating that selection for improved tolerance might be possible. Simazine and atrazine caused leaf discoloration (yellowing). The addition of a penetrant to atrazine made no visible difference. At the finish of the trial when plants were removed from the glasshouse and placed in full natural sunlight, plants previously sprayed with atrazine died. 2,4-D caused swelling of the nodes, shortening of the internode length, and brittleness of stolons, to a greater extent than did dicamba. This supports previous observations by Quesenberry (pers.comm.). Limpo grass was also sensitive to 2,4-D when applied to the soil. Pendimethalin caused slight reddening of leaves from foliar and soil applications. No symptoms of phytotoxicity resulted from metolachlor applications.

Post-planting herbicide field trial

Annual poa, summer grass, perennial ryegrass (*Lolium perenne*), Yorkshire fog (*Holcus lanatus*), dove's foot (*Geranium molle*), black nightshade (*Solanum nigrum*) and Scotch thistle (*Cirsium vulgare*) were the main weed species in the trial. 2,4-D and triclopyr (Grazon) adversely affected limpo grass (Table 2), but adequately controlled broadleaf weeds. Dicamba did not affect limpo grass or other grass weeds, but selectively killed or suppressed broadleaf species. Metolachlor and pendimethalin had no visible effect on either limpo grass or weeds which had already emerged at the time of application. Bentazone (Basagran) suppressed growth of broadleaf weeds with no apparent damage to limpo grass or grass weeds. Ethofumesate (Nortron) temporarily suppressed annual poa growth but did not kill it. No deleterious effects on limpo grass from ethofumesate application were apparent, contrary to the results of Davies and Hunt (1989). Atrazine caused browning and some death of annual poa, and had a slight effect on some broadleaf weeds, but failed to kill them. Responses to atrazine varied considerably between the replicates. Limpo grass plants on both atrazine and simazine plots were unaffected.

TABLE 2: Effect of different post-planting herbicide treatments applied on 1 March 1993, on the density of limpo grass on 24 May 1994.

Herbicide	Rate (kg ai/ha)	Established limpo grass (No.plants/m ²)
atrazine	1.5	1.7
simazine	1.5	1.9
2,4-D	2.2	0.8
dicamba	0.4	2.2
triclopyr	1.8	1.5
ethofumesate	2.0	1.4
pendimethalin	2.0	1.7
metolachlor	2.9	2.1
bentazone	1.0	1.1
Untreated		1.5
LSD (0.05)		1.1

Pre- and post-planting herbicide field trial

Pre-planting herbicide applications suppressed annual poa establishment and growth more than the post-planting applications. Pre-planting applications of atrazine and metolachlor were more successful than other herbicide treatments at suppressing weeds, but metolachlor affected limpo grass more than atrazine. In both pre-and post-planting metolachlor treatments, annual poa was suppressed, particularly in the pre-

planting treatment. Dicamba had no effect on grass suppression. Atrazine and dicamba had the least effect on limpo grass in both pre- and post-planting treatments.

TABLE 3: Limpo grass condition and percentage of bare ground in June 1993, three months after pre- and post-planting applications of herbicides.

	Herbicide rate (kg ai/ha)	Mean % bare ground		Limpo grass condition score	
		Pre-plant	Post-plant	Pre-plant	Post-plant
atrazine	1.5	32	8	4.7	5.0
simazine	1.5	23	7	4.3	4.3
metolachlor	2.9	35	10	3.0	4.0
pendimethalin	2.0	18	12	4.0	4.7
dicamba	0.6	0	0	5.0	4.7
LSD (0.05)				1.4	0.9

0 = dead, 5 = leafy no damage symptoms

CONCLUSIONS

Best weed suppression in establishing limpo grass will result from an integrated control programme. This should include a cropping phase prior to stolon establishment in late spring, ample cultivation, pretreatment of stolons to encourage rapid plant development, use of both pre- and post-planting selective herbicides to suppress annual grasses and broadleaf weeds, and a combination of protective nurse crops and selective herbicides during winter and spring.

Pre-planting application of atrazine or a white mustard nurse crop should provide suppression of annual poa. Dicamba provides adequate control of most broadleaf weeds, but its usage is not compatible with legumes. Atrazine, simazine, ethofumesate and metolachlor may offer selective post-planting control of annual poa during winter, but results have been variable. Further research into selective annual grass killers, quantification of benefits, and reasons for variable results, is required.

Paraquat, glyphosate and fluazifop-butyl are options for controlling limpo grass in the unlikely event of it becoming a problem weed. Genotypic variation in tolerance to some herbicides may allow selection for increased tolerance within limpo grass cultivars.

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